Stability studies of the inclusion complexes of hydroxytyrosol with cyclodextrins

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Introduction Hydroxytyrosol (HT), the polic phenol derived from the olive tree, is a potent antioxidant with great beneficial health effects. However, it is highly reactive to oxygen, light, and heat and presents high instability. Additionally, HT consumption leads to very low concentrations of the molecule in the circulation due to the intense metabolism that undergoes in the bowel. Microencapsulation arises as a strategy to overcome these barriers. The aim of this study was to examine the stability of the solid products of the inclusion of hydroxytyrosol into ?-cyclodextrin and ?-cyclodextrin.
Methodology Aqueous solutions of the HT and each cyclodextrin were prepared, and freeze drying was applied for the encapsulation in 1:1 molar ratio. The produced solid complexes were studied using differential scanning calorimetry (DSC), under oxidative conditions. Furthermore, in vitro release of the encapsulated complexes under simulated digestion conditions was also evaluated.
Results The DSC oxidation curve of the pure HT reveals the initiation of an exothermic phenomenon at 236?C, which could be attributed to the onset of the oxidation process of HT. The oxidation onset was shifted regarding ?-CD/HT and ?-CD/HT complexes. A larger shift was observed at the complex formed with ?-CD in comparison with ?-CD (251 and 243?C, respectively). Regarding the in vitro release, the two inclusion complexes presented similar behavior under oral and intestinal conditions. In the gastric phase, ?-CD seemed to retain HT under complexation rather more efficiently than ?-CD after 30 min of simulated digestion. However, no difference was observed in the two CDs' behavior after 60 min of digestion. The findings support a controlled release of HT in the intestinal site, where absorption takes place and delivery of approximately 40% of HT to the colon.
Conclusions The complexation of HT to both ?-CD and ?-CD, protects the molecule against thermal oxidation and increases its bioavailability after consumption. This study's results are promising for producing a stable complex of hydroxytyrosol which can easily be incorporated into foods.